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Centigrade and Body Temperature Based Fan Speed and AC Load Controller

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ABSTRACT

This study introduces the system of temperature based controlled fan and load. This makes a smart system methodology and reduces our work, it is our main domain. It automatically controls the speed of the fan. This project introduces an ARDUINO UNO-based automatic room temperature fan speed and AC load controller. The purpose of this presentation is to provide an overview of a standalone automatic fan speed controller that regulates fan speed in accordance with our needs. The DS18B20 temperature sensor are intended to be detected by this system, which then transforms the data into an electrical analogue signal that can be applied to the microcontroller. On the 16*2-line LCD, the temperatures sensed and set values are shown. The system is user-friendly because to the Liquid Crystal Display (LCD). The temperature sensor also measures our body temperature, based on that it will control the fan speed and AC load which we connected. On the LCD panel, it also shows our body temperature. The power supply for this project is regulated from adapter with the voltage of 12V, 2A. It can be used for many different purposes, including as air conditioners, water heaters, incubators, snow-melters, heat exchangers, furnaces, and thermal pots. It is also highly compact.

Keywords: Temperature sensors; Microcontroller; Control algorithm; Fan speed control; AC load management; Relay control; Safety features; User interface; Energy efficiency; Comfort optimization; Sensor technology; HVAC systems; Sustainability; Indoor climate control.

1. Introduction

The most frequently spelled term in the field of electronics is automation. Due to its user-friendly nature, these had greater importance done any other technology. Using existing switches in home which may produce sparks and also results in fire accidents in few conditions. This project is about creating an automatic fan control system that automatically turns the fan on and off depending on the room temperature. We used an Arduino uno microcontroller here, we can also use in MINI, but there will be some problems with power regulations, so choose UNO.

The temperature sensor, here is a DS18B20 module but we can use and it will also give the most accurate readings. When the heat is applied to the temperature sensor, this will determine the fan automatically increasing or decreasing in speed according to the speed level normal fan that are set to different temperature changes in room. The NPN transistor acts as a switch and controls the fan speed depending upon temperature. IN4007 diode controls the fan from being damaged. The LED glows whenever the temperature attains maximum. Temperature-based LED controllers are devices designed to adjust the brightness or colour of LED lights in response to changes in temperature. These controllers typically include sensors to measure ambient temperature, and their programming allows for automatic adjustments to the connected LED lighting based on the temperature readings.

The primary goal of these controllers is to enhance user comfort, energy efficiency, and create dynamic lighting environments. They find applications in various settings such as smart homes, offices, or commercial spaces where adaptive lighting can contribute to a more pleasant and efficient environment. Users can customize settings to define the relationship between temperature changes and LED behaviour, enabling a seamless integration of lighting control with ambient conditions. This technology provides an innovative way to optimize lighting solutions for both aesthetic and functional purpose.

2. Literature Survey

This Temperature based fan speed controller proposed by Siva Shanmathi et al. (2014) on the basis of LM 35 Temperature sensor. The drawback of this project was, the sensor which was used was water resistant, so it is sensitive to water. It can't reduce the heat quickly. This Room temperature based fan speed control system using Pulse Width Modulation Technique was introduced by Vaibhav (2013), it was based on appropriate according to the modern lifestyle. The simulation of the system has been done on Proteus Professional Software volt of 8.

The proteus software is expensive when compared to other electronic design and simulation software is a major disadvantage of this study. This temperature sensitive voltage regulator for ac load using RTD was proposed by Haider Bulbul (2015) in this study, the RTD was able to take the reading from 26^{o}C to 38^{o}C accurately. Moreover, the room temperature is also made visible by two 7-segment display. RTD (Resistance temperature detector) is changes with the change in temperature are major disadvantage of this project. The Temperature based LED indication system was initiated by Shekhar Mishra et al. (2017) it senses the actual temperature of the system to convert the temperature recorded by the sensor into digital and to turn on the LED on or off. The led can expose to high temperature also it leads to drawback.

3. Proposed Work

3.1. Architecture Design

The objective of implementing a Celsius-based light controller is to optimize energy efficiency and enhance user comfort by dynamically adjusting light intensity in response to ambient temperature changes. The main purpose is to control the fan and AC load based on temperature. It will turn on and off based on increase in temperature. For this we are using a DS18B20 Temperature sensor which measures the room temperature and display on LCD display. When it increases above or at 50 degree Celsius, the fan will rotate and AC LOAD will be turn on.

Here we connect the ac load was 5 watts BULB. Key goals include precise calibration for effective temperature responsiveness, the integration of hysteresis to prevent rapid speed fluctuations, and ensuring that the controller contributes to both energy savings and the longevity of the fan. Additionally, the objective may involve integrating the fan speed controller with smart systems for remote monitoring and control, providing a balance between energy efficiency and effective thermal management.

In the proposed systems, microcontroller plays a vital role in the smart systems development. Microcontrollers have become an essential part in the present technologies that are being presented daily. This article discusses temperature based fan speed control and monitoring system using an Arduino system. This system is used to control the cooling system automatically based on the room temperature. The system uses an Arduino board to implement a control system. Since this system is proposed to control the cooling system and it is very important to know Arduino controlled system well. The temperature-based fan speed control system can be done by using an electronic circuit using an Arduino board. Now Arduino board is very progressive among all electronic circuits, thus we employed Arduino board for fan speed control. The proposed system is designed to detect the temperature of the room and send that information to the Arduino board. Then the Arduino board executes the contrast of current temperature

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and set temperature based on the inbuilt program of the Arduino. The outcome obtained from the operation is given through the o/p port of an Arduino board to the LCD display of related data. The generated pulses from the board which is further fed to the driver circuit to get the preferred output to the fan.

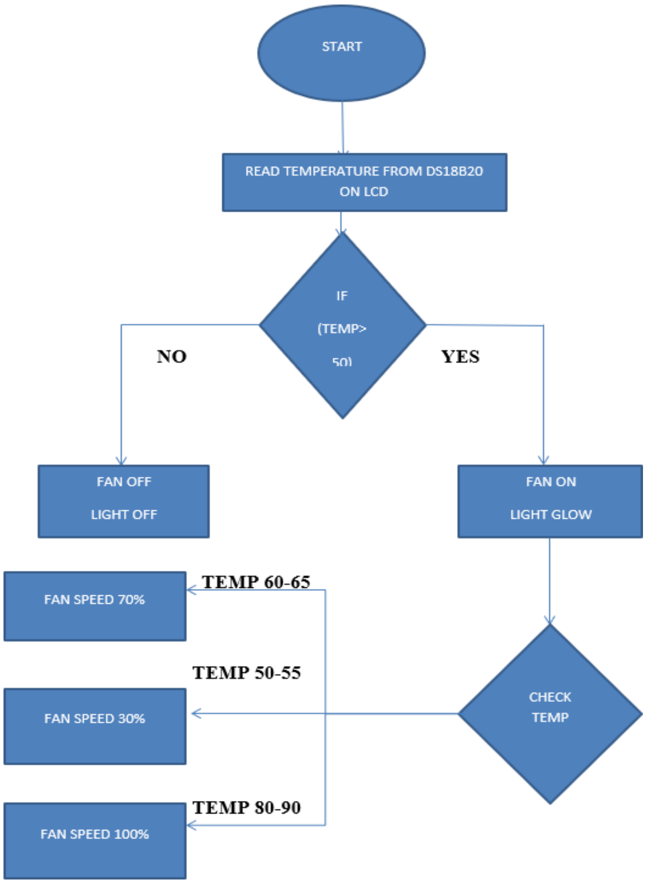

Figure 1. Block Diagram

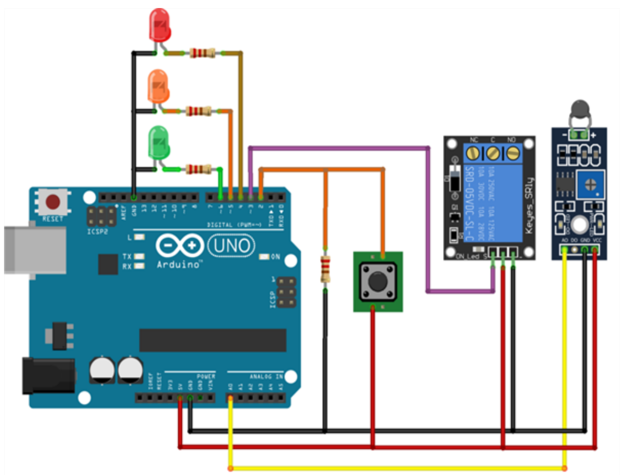

Figure 2. Circuit diagram

3.2. Circuit Operation

We have used Arduino as the main microcontroller, it is at the heart of this project as it controls all functions. The DS18B20 Temperature sensor is used to measure the surrounding temperature and sends data to the Arduino. Arduino calculates the temperature using this data, and then it generates pulse-width modulation (PWM) signal and

gives to the NPN Transistor. The NPN transistor acts as a controller switch, it creates a voltage according to the PWM input which controls the speed of the fan. The fan speed is directly proportional to the surrounding temperature. When the temperature is increasing the fan speed is also increased and when the temperature is decreasing the fan speed is also decreased. We can show the temperature values and fan speed levels on the LCD display.

The lightbulb is turned on and off employing a digital output from the Arduino board via a solid-state relay. The solid-state relay is basically an electrical switch that can connect/disconnect a (possibly high-power) device to an AC source with a low- power DC signal. In our case, the AC source comes from a standard wall outlet and the DC signal is supplied by a Digital Output from our Arduino board. Therefore, our solid-state relay needs to be able to handle 120-240 V on the AC side (in North America need 120 V) and the DC side must be able to be controlled with a 5 V signal. Since our load (the lightbulb) is resistive (not inductive) and doesn't require much current.

The system is equipped with temperature sensors, such as thermistors or digital temperature sensors, which continuously monitor the ambient temperature in the area where the system is installed. A user can set a threshold to turn the bulb on when the temperature exceeds a certain value and turn it off when it falls below another value. If the temperature rises above a specified threshold, the system triggers the light bulb to turn on. If the temperature falls below a different threshold, the system commands the light bulb to turn off.

4. Component Description

4.1. Arduino UNO

Arduino UNO is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The word "uno" means "one" in Italian and was chosen to mark a major redesign of the Arduino hardware and software.

The Uno board was the successor of the Duemilanove release and was the 9th version in a series of USB- based Arduino boards. Version 1.0 of the Arduino IDE for the Arduino Uno board has now evolved to newer releases. The ATmega328 on the board comes preprogrammed with a bootloader that allows uploading new code to it without the use of an external hardware programmer. While the Uno communicates using the original STK500 protocol [1], it differs from all preceding boards in that it does not use a FTDI USB-to-UART serial chip. Instead, it uses the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

4.2. 12V single channel relay

It is a 12V 1-channel relay interface board with screw terminal, it can be controlled directly by a wide range of microcontrollers such as Arduino, AVR, PIC, ARM and so on. The board has a high quality relay, which can handle a maximum of 15A @ 125V or 10AA @ 250V AC. Relay has three connections - Common - C, Normally Open-NO, Normally Closed-NC brought out to 3 pin screw terminals which makes it easy to make and remove connections. The board has a power indication and a relay status LED to ease debugging. Power input and relay

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control signals are brought to header pins on the board. Hence, the board can be easily interfacing with our development boards using our jumper wires.

The features include are:

(1) Brand new and high quality;

(2) 1-Channel Relay interface board;

(3) Equipped with high-current relay: 15A @ 125V or 10AA @ 250V;

(4) A Standard interface that can be controlled directly by microcontroller (Arduino, 8051, AVR, PIC, DSP, ARM).

4.3. NPN Transistor

When the emitter-base junction is forward biased, a small voltage VBE is seen. Reverse bias voltage VCE. Due to the forward bias, the majority charge carriers in the emitter are repelled towards the base. The electron-hole recombination is very small in the base region since the base is lightly doped. Most of the electrons cross into the collector region .When the emitter is forward biased, electrons move towards the base and create the emitter current IE. Here, the majority charge carriers in the P-type material combine with the holes. Since the base of the NPN transistor is lightly doped, it lets only a few electrons to combine and the remaining current is known as the base current IB. When the collector region is reverse biased, it applies a greater force on the electrons reaching the collector junction and hence attracts the electrons at the collector.

4.4. Liquid Crystal Display

The LCD is a dot matrix liquid crystal display that displays alphanumeric characters and symbols. 16X2 LCD digital display has been used in the system to show the room temperature. Liquid Crystal Display screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD.

4.5. Temperature sensor

The DS18B20 is a 1-wire programmable Temperature sensor from maxim integrated. It is widely used to measure temperature in hard environments like in chemical solutions, mines or soil etc. The constriction of the sensor is rugged and also can be purchased with a waterproof option making the mounting process easy. It can measure a wide range of temperature from -55°C to +125° with a decent accuracy of ±5°C. Each sensor has a unique address and requires only one pin of the MCU to transfer data so it a very good choice for measuring temperature at multiple points without compromising much of your digital pins on the microcontroller.

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5. Result and Discussion

5.1. Result

Controlling fan speed based on temperature in Celsius can optimize energy usage and maintain a comfortable environment. By adjusting fan speed according to temperature, you can achieve more efficient cooling, reducing power consumption when conditions allow. This approach is especially beneficial for climate control systems in various applications, such as HVAC in buildings or cooling systems in electronic devices. The fan speed controller relies on a temperature sensor to measure the ambient temperature. As the temperature increases, the controller adjusts the fan speed accordingly. This can lead to energy savings compared to running the fan at a constant speed. Additionally, it helps prevent unnecessary noise and wear on the fan.

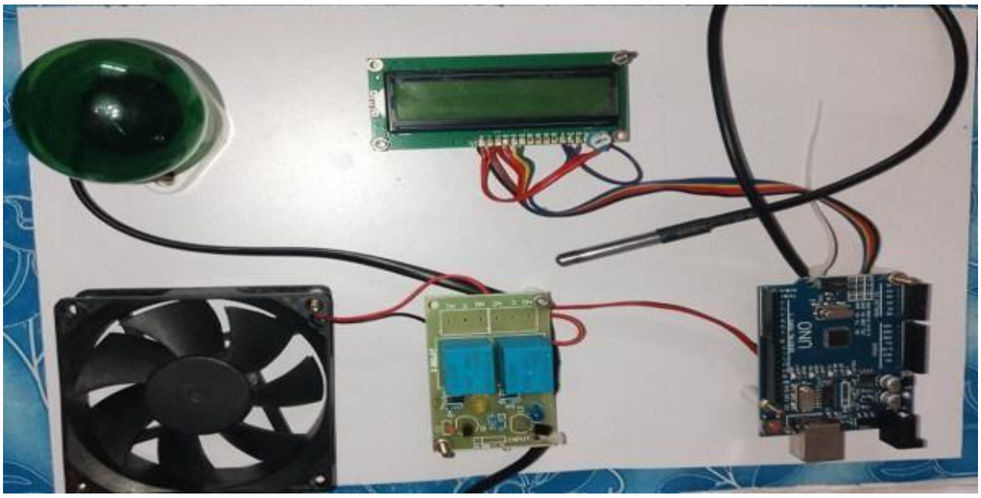

Figure 3. Designed Circuit

Creating a fan speed and AC load controller based on centigrade and body temperature involves integrating temperature sensors with a control system to adjust fan speed and AC load accordingly. These sensors, typically thermistors or thermocouples, are strategically placed to monitor both room temperature (in centigrade) and body temperature. The heart of the system lies in a microcontroller or processor, tasked with collecting temperature data and executing control commands. A sophisticated control algorithm is developed to interpret temperature readings and make decisions on fan speed and AC load settings. By defining thresholds for temperature ranges, the algorithm dynamically adjusts fan speed and AC load to maintain optimal comfort levels. The fan speed control mechanism employs techniques like Pulse Width Modulation (PWM) to regulate the fan's rotational speed based on the output from the microcontroller.

Similarly, the AC load is managed through a relay or solid-state relay controlled by the microcontroller, allowing it to activate or deactivate the air conditioning system as required. Safety features are integrated into the design to ensure protection against overheating or other hazards, including emergency shutdown protocols triggered by temperature spikes. While optional, a user interface can enhance usability, allowing users to monitor temperatures and adjust settings manually through an LCD display or smartphone app. Thorough testing and calibration are essential to validate the system's performance under diverse conditions. This includes fine-tuning the temperature sensors and control algorithm for accuracy and reliability. Collaboration with electronics and HVAC experts

ensures the design meets power requirements, environmental considerations, and regulatory standards, optimizing its effectiveness for the intended application.

5.2. Discussion

However, fine-tuning is crucial to avoid frequent speed fluctuations that might be disruptive. Implementing hysteresis (a range of temperatures within which no action is taken) can prevent the fan from rapidly switching speeds due to minor temperature variations. In summary, a Celsius-based fan speed controller offers energy efficiency, noise reduction, and equipment protection, making it a practical choice for temperature-regulated cooling systems in various settings. The discussion emphasized the importance of fine-tuning for optimal performance, integration with other sensors for enhanced intelligence, user customization for flexibility, smart system connectivity for remote control, and maintenance considerations for sustained efficiency and reliability. Overall, the results and discussion highlight the potential of Celsius-based light control for creating efficient, adaptive, and user-friendly lighting environments. Integrating centigrade and body temperature-based controls for fan speed and AC load management presents a promising avenue for enhancing both comfort and energy efficiency in indoor environments. By leveraging temperature sensors strategically positioned to capture ambient and human body heat, this system offers a nuanced understanding of thermal dynamics within a space. The core of the system lies in a microcontroller or processor, which interprets temperature data through a sophisticated control algorithm. This algorithm dynamically adjusts fan speed and AC load settings, optimizing them to maintain desired temperature levels while minimizing energy consumption.

The implementation of fan speed control mechanisms, such as Pulse Width Modulation (PWM), enables precise regulation of airflow based on real-time temperature readings. Similarly, the integration of relay or solid-state relay controls allows for seamless activation or deactivation of the AC load in response to temperature fluctuations. Moreover, the incorporation of safety features ensures protection against potential hazards, including automatic shutdown protocols triggered by abnormal temperature spikes, thereby enhancing system reliability. While optional, the inclusion of a user interface adds a layer of convenience, allowing occupants to monitor temperature levels and adjust settings manually as desired. This not only empowers users to customize their comfort preferences but also fosters greater engagement with energy-saving practices. Rigorous testing and calibration are imperative to validate the system's functionality across diverse conditions, ensuring accurate temperature sensing and responsive control actions. Collaboration with experts in electronics and HVAC systems is essential throughout the design and implementation process to optimize performance, address technical challenges, and adhere to regulatory standards. By leveraging advancements in sensor technology and control algorithms, centigrade and body temperature-based fan speed and AC load controllers hold immense potential for revolutionizing indoor climate management, promoting comfort, sustainability, and energy efficiency.

6. Conclusion

In conclusion, both the Celsius-based fan speed controller and light controller showcase significant potential for enhancing energy efficiency, user comfort, and adaptability in various applications. In conclusion, the integration of centigrade and body temperature-based controls for fan speed and AC load management represents a significant

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advancement in indoor climate control systems. By harnessing temperature data from strategically positioned sensors, these systems offer precise and responsive adjustments to maintain optimal comfort levels while minimizing energy consumption. The utilization of sophisticated control algorithms, along with mechanisms such as Pulse Width Modulation (PWM) for fan speed control and relay-based AC load management, ensures efficient operation and enhances occupant comfort. Furthermore, the inclusion of safety features and optional user interfaces adds layers of reliability and convenience to the system, enhancing its usability and effectiveness. Rigorous testing and calibration procedures are essential to validate the system's performance across various conditions and ensure its accuracy and reliability.

7. Future Scopes

- Incorporation of additional sensors to monitor humidity, light, and air quality.
- Capability to analyze and display data trends over time, providing insights into environmental changes.
- Ability to adjust fan speed and AC load based on user preferences and environmental conditions.
- Enhanced connectivity with IoT devices for real-time monitoring and control.
- Use in automotive applications for climate control systems, enhancing passenger comfort.

Declarations

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This study did not receive any grant from funding agencies in the public, commercial, or not-for-profit sectors.

Competing Interests Statement

The authors declare no competing financial, professional, or personal interests.

Consent for publication

The authors declare that they consented to the publication of this study.

References

[1] Vaibhav, B., & Pawan, W. (2013). A Secured Dual Tone Multifrequency Based Smart Elevator Control System. International Journal of Research in Engineering and Advanced Technology, 1(4).

[2] Luo, F., Zhao, X., & Xu, F. (2010). A new hybrid elevator group control system scheduling strategy based on particle swarm simulated annealing optimization algorithm. Intelligent Control and Automation, Pages 5121–5124.

[3] Hsu, T.H., et al. (2008). Development of an automatic parking system for vehicle. In Proc. of the International Conference on the IEEE Vehicle Power and Propulsion, Pages 1–6.

[4] Anagopoulos, I., Pavlatos, C., & Papakonstantinou, P. (2005). An Embedded Microprocessor for Intelligent Control. Journal of Intelligent and Robotic Systems, 42: 179–211.

[5] Islam, M., Rafi, F.H., Mitul, A.H., & Ahmad, M. (2012). Development of a Noninvasive Continuous Blood pressure Measurement and monitoring system. In Proc of the International conference on ICIEV, Pages 1085–1090.

[6] MohanKumar, A., Suresh Kumar, K., & Gowtham, R. (2023). Revolutionizing Plastic Waste Management: Fuel Production from Discarded Plastics. Asian Journal of Applied Science and Technology, 7(3).

[7] Kwakyea, S., & Baeumner, A. (2007). An embedded system for portable electrochemical detection. Sens. Actuat. B., 123(1): 336–343.

[8] Fu, J.H. (2008). Remote control system using infrared technology based on PIC16F873 microcontroller. Electron. Technol., 45(10): 68–70.

[9] Xiaodong, X. (2011). Based on Single Chip Microcomputer Remote Wireless Control System Design. Coal Mine Machinery, 32(8): 202–204.